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**BRAKE PRESS SAFETY APPARATUS**
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- (56) Prior Art Documents  
**AU 566795 35142/84 F16P 3/14**  
**US 4166369**  
**AU 509436 24932/77 F16P 3/14 G08B 13/18**
- (57) Claim
1. A safety apparatus for use with a press brake of the kind having a moving blade provided with a leading edge and a platform against which an item may be pressed, the safety apparatus including:

a corresponding light emitting means and light receiving means for mounting in fixed relationship with the leading edge of the moving blade, so as to move in conjunction with the blade, said light emitting means being mounted at one end of the moving blade forwardly and laterally of the leading edge, and the corresponding light receiving means being mounted at the opposing end of the moving blade;

said light emitting means emitting a beam of light in parallel and substantially forward and lateral prescribed relationship to the leading edge, and said corresponding light receiving means being disposed to receive the beam of light; and

control means connected to said light receiving means to sense receipt of the emitted beam by said light receiving means, and to the press brake to

control halting operation of the moving blade, whereby said control means causes the cessation of movement of the blade in response to a sensed interruption of receipt of an emitted beam.

12. An apparatus including:

a press brake having a moving blade provided with a leading edge, said blade having opposite ends and opposite sides, and a platform against which an item may be pressed; and

a safety apparatus connected to said press brake as claimed in any one of claims 1 to 10.

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INVENTION TITLE: "BRAKE PRESS SAFETY APPARATUS"

ASSOCIATED PROVISIONAL APPLICATION NOS:

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The following statement is a full description of this invention including the best method of performing it known to me/us:-

The present invention relates to a press brake safety apparatus.

Presently, there may be provided on a press brake an arrangement of infra red light curtains lying in a plane substantially parallel to that defined by the blade of the brake press. Breaking this light curtain at any level will halt operation of the  
5 press brake.

Such arrangements serve to prevent an operator having any part of their body, particularly their hands, near or under the blade when the pressing operation takes place. In addition to the light curtains the press operates in an incremental manner so that movement of the blade over an increment requires a positive  
10 action, such as depressing a foot pedal. This too is intended to increase safety.

This present arrangement results in numerous unnecessary interruptions in the operation of the press brake. In particular, breaking the light curtain at a point where no danger is possible, such as 450mm from the blade, or during the slow incremental progress of the blade, will cause an unnecessary interruption in the  
15 operation of the press brake.

Also, failure of the light curtain in some manner can leave the operator unaware and therefore in danger of injury.

At present, a rear side of the blade is required to be enclosed by a mechanical and physical barrier. This precludes access to the rear of the blade during  
20 operation thereof thereby further reducing the efficiency and efficacy of the press brake. In addition, this requirement can limit the type of jobs performed by the press brake.

The present invention attempts to overcome each of the abovementioned problems associated with the prior art.



2 In accordance with one aspect of the present invention  
3 there is provided a ~~brake~~ press<sup>brake</sup> safety apparatus for use on  
4 a ~~brake~~ press<sup>brake</sup> of the kind having a moving blade having a  
5 leading edge and a platform against which an item may be  
6 pressed, the safety apparatus comprising at least one beam  
7 of light mounted at a level marginally forward of and  
8 substantially parallel to the leading edge so as to move  
9 with the blade, the interruption of the beam causing the  
10 movement of the blade to stop and thereby halting operation  
11 of the ~~brake~~ press<sup>brake</sup> without the leading edge contacting the  
12 item.

13 Preferably, a single beam is mounted each side of the blade  
14 and running substantially parallel thereto.

15 Still preferably, interruption of the beam will also result  
16 in the lighting of warning lights mounted on the ~~brake~~  
17 press<sup>brake</sup>. Also, the beam will be electronically linked to a  
18 form of programmable logic controller such that the  
19 function of the ~~brake~~ press<sup>brake</sup> may be governed thereby.

20 The present invention will now be described, by way of  
21 example only, with reference to the following drawings:-

22 Figure 1 is a front view of a ~~brake~~ press<sup>brake</sup> incorporating the  
23 safety apparatus of the present invention;

24 Figure 2 is an upper perspective view of part of the safety  
25 apparatus and ~~brake~~ press<sup>brake</sup> of Figure 1;

26 Figure 3(a), (b) and (c) is a partial side view cross  
27 section of the safety apparatus and ~~brake~~ press<sup>brake</sup> of Figure 1  
28 in use;

29 Figure 4(a), (b) and (c) is a partial side view cross  
30 section of the safety apparatus and ~~brake~~ press<sup>brake</sup> of Figure 1



in use;

Figure 5 is a partial side view cross section of the safety apparatus and press brake of Figure 1 having an additional infra red beam provided thereon;

Figure 6 is a partial side view cross section of the safety apparatus and press  
5 brake of Figure 5 having a number of additional infra red beams provided at the front thereof;

Figure 7 is a partial side view cross section of the safety apparatus of Figure 5 having additional fixed rear beams for special sheet profiles.

Figure 8 is a ladder diagram of the program for a Programmable Logic Collector  
10 (PLC) for use in the present invention.

In Figure 1 there is shown a press brake 10 comprising a housing 12, a blade frame 14 and a base 16. The blade frame 14 has provided therein a blade 18 and two pivot means 20, as can be seen in Figure 2. The two pivot means 20 are located one at each end of the blade 18.

15 Both a light emitter means 22 and a light receiving means 24 are mounted to each pivot means 20 and as such are rigidly linked to the blade frame 14. The light emitter means 22 and light receiving means 24 linked to each pivot means 20 are arranged so as to be opposed to the light receiving means 24 and light emitter means 22 respectively linked to the other pivot means 20, as can be best  
20 seen in Figure 2.

A beam of light 26 passes between each opposed light emitter means 22 and light receiving means 24. Each light emitter means 22 and light receiving means 24 has a light scatter guard 28 provided thereon. The beams 26 run



2 substantially parallel to the blade 18 on a front side 18a  
3 and a rear side 18b thereof.

4 A number of over-ride means in the form of switches 30 are  
5 also provided on the blade frame 14. The blade frame 14  
6 has a number of warning means in the form of lights 32  
7 provided thereon.

8 The ~~brake~~ press<sup>brake</sup> 10 incorporates a manual operator means in  
9 the form of a foot switch 34, as can be seen in Figure 1.

10 The blade 18 is mounted in a substantially upright manner  
11 and has a leading edge 36, as shown in Figures 2 to 4.

12 The base 16 has a platform 38 having a recess 40 provided  
13 therein. An item of material to be pressed into the recess  
14 40, for example a sheet 42 may be provided on the platform  
15 38, as shown in Figures 3 and 4. It is to be understood  
16 that the recess 40 may take any form required by a user of  
17 the ~~brake~~ press<sup>brake</sup> 10.

18 In Figure 4 there is shown a user's hand 44 manipulating  
19 the sheet 42.

20 In Figure 5 there is shown the blade 18 and platform 38 of  
21 Figures 3 and 4 having a feeler light beam 50 provided  
22 therewith. The feeler beam 50 runs substantially parallel  
23 to the blade 18 and is located substantially directly  
24 forward of, and spaced apart from, the leading edge 36  
25 thereof.

26 In Figure 6 there is shown a number of light beams 52  
27 arranged to run substantially parallel to the front 18a of  
28 the blade 18 in a vertical configuration forming a sheet  
29 54. Such a configuration is intended for a blade 18 having  
a number of sections thereto which are set at differing



2 levels above the platform 38.

3 In Figure 7 there is shown a number of light beams 56  
4 arranged to run substantially parallel to the rear face 18b  
5 of the blade. The light beams 56 form a vertically  
6 disposed sheet 58 and a horizontally disposed sheet 60.

7 A form of Programmable Logic Controller (PLC) is provided  
8 for the operation of the brake press <sup>brake</sup> 10 and associated  
9 safety apparatus, as shown in Figure 8. The PLC is  
10 electronically linked to the footswitch 34, the light  
11 emitter means 22 and light receiving means 24, the switches  
12 30, the lights 32 and a hydraulic motor (not shown) driving  
13 the blade frame 14 and blade 18. This linking is arranged  
14 in a manner allowing co-ordination of the operation of the  
15 brake press <sup>brake</sup> as described in the following paragraphs.

16 In use, a sheet 42 to be pressed is inserted in the brake  
17 press <sup>brake</sup> <sub>/</sub> 10 so as to overlay the platform 38, as can be best  
18 seen in Figures 3(a), 4(a), 5,6 and 7.

19 Each light emitter means 22 and light receiving means 24  
20 pair is arranged so that the beam 26 therebetween is  
21 positioned marginally forward of the leading edge 36 of the  
22 blade 18, as can be seen in Figures 3,4,5,6 and 7.

23 Particularly now with reference to Figures 3 and 4, upon an  
24 initial activation of the footswitch 34, if the beams 26  
25 are uninterrupted, the blade frame 14 will descend from a  
26 raised position. Accordingly, the blade 18 and light means  
27 22 and 24 move with the blade frame 14.

28 When the leading edge 36 of the blade 18 is approximately  
29 8mm away from the platform 38 the blade frame 14 will stop,  
30 as shown in Figure 3(b), at what is termed the "rip



2 point". The <sup>mute</sup> ~~rip~~ point is set by the user of the brake  
3 press <sup>brake</sup> 10.

4 To have the blade 18 contact the sheet 42 an operator must  
5 again activate the footswitch 34. At this time, the  
6 interruption of the beams 26 is overridden by the PLC  
7 allowing contact with the sheet 42 despite the beams 26  
8 being interrupted. After such contact, the blade 18 and  
9 associated components return to their raised position while  
10 the sheet 42 has been suitably shaped by the interaction of  
11 the blade 18 and recess 40, as shown in Figure 3(a).

12 If either or both of the beams 26 are interrupted after  
13 initial activation of the footswitch 34, say for example by  
14 a user's hand 44, the blade 18 and associated components  
15 will firstly stop and then return to their initial raised  
16 position, as can be seen in Figure 4.

17 The interruption of either or both beams 26 by any  
18 obstruction will cause the lights 32 to activate.

19 If one or more light means 22 and 24 are misaligned the  
20 blade 18 and associated components will return to the  
21 raised position and cause activation of the lights 32.

22 It may be necessary to over-ride the normal operation  
23 described above, for example during set-up of the brake  
24 press 10. This may be accomplished by activating one or  
25 more switches 30. In this condition, the blade 18 and  
26 associated components may only advance by a predetermined  
27 distance, for example 10mm, upon each activation of the  
28 footswitch 34. Each of the above functions is provided for  
29 by the Programmable Logic Controller (PLC), as shown in  
Figure 8. Accordingly, the integers of the PLC are



2 arranged and interconnected in a manner that allows,  
3 amongst other functions, the return of the blade 18 and  
4 associated components to the raised position upon  
5 interruption of a single or both beams 26.

6 The addition of the feeler beam 50 as seen in Figures 5 to  
7 allows breaking of it to stop descent of the blade frame  
8 14 and blade 18. As such, it is not possible for a user to  
9 set a ~~max~~<sup>max</sup> point on the brake press<sub>10</sub><sup>brake</sup> that is smaller than  
10 the distance of the feeler beam 50 from the leading edge 36  
11 of the blade.

12 The addition of the sheet 54 of beams 52, as can be seen in  
13 Figure 6, allows interruption of these beams 52 to stop the  
14 blade 18. Such an arrangement is envisaged to be necessary  
15 if the blade 18 comprises a number of sections and where at  
16 least two thereof are set at differing levels above the  
17 platform 38. This would require two or more nip points  
18 corresponding to the two or more levels of sections  
19 comprising the blade 18. Once a first nip point was  
20 reached and it became necessary to override the  
21 interruption of beams 50 and 26 to allow contact of the  
22 blade 18 and the sheet 42 it is possible that a user may  
23 insert his hand 44 between the sheet 42 and a following nip  
24 point. If this was to happen then the interruption of  
25 beams 52 will halt the blade 18 and return it and its  
26 associated components to their raised position.

27 The addition of the beams 56 forming a sheet 58 and a  
28 mechanical barrier 60 protect against access to the blade  
29 18 from the rear 18b thereof, as can be seen in Figure 7.  
30 Interruption of the beams 56 results also in the stopping



2 of the descent of the blade 18 and returns it and its  
3 associated components to their raised position.

4 It is envisaged that infra-red light or laser (Light  
5 Amplification by Stimulated Emission of Radiation) light  
6 may be used to form the beams 26, 50, 52 and 56.

7 It is also envisaged that the pairs of opposed light  
8 emitter means 22 and light receiving means 24 may be  
9 replaced by a single means capable of both emitting and  
10 receiving a light beam in combination with a reflective or  
11 mirror means located opposite thereto. One of these units  
12 could be mounted either side of the blade 18.

13 Still further, it is to be understood that any obstruction,  
14 and not only a users hand 44 interrupting the beams 26 will  
15 cause the descent of the blade 18 to stop.

16 The arrangement of the present invention allows an operator  
17 to work close to the blade 18 without being able to entrap  
18 his or her hands between the blade 18 and sheet 42 or  
19 platform 38. In addition, the rear of the brake press need  
20 not be enclosed by mechanical and physical barriers which  
21 restrict access thereto.

22 The non-incremental form of movement of the blade 18 in  
23 normal operation reduces stress on machine hydraulics and  
24 continuous activation of the foot switch 34.

25 Modifications and variations such as would be apparent to a  
26 skilled addressee are deemed within the scope of the  
27 present invention.

The Claims defining the invention are as follows:-

1. A safety apparatus for use with a press brake of the kind having a moving blade provided with a leading edge and a platform against which an item may be pressed, the safety apparatus including:
  - 5      a corresponding light emitting means and light receiving means for mounting in fixed relationship with the leading edge of the moving blade, so as to move in conjunction with the blade, said light emitting means being mounted at one end of the moving blade forwardly and laterally of the leading edge, and the corresponding light receiving means being mounted at the opposing end of the moving blade;
  - 10     said light emitting means emitting a beam of light in parallel and substantially forward and lateral prescribed relationship to the leading edge, and said corresponding light receiving means being disposed to receive the beam of light; and
  - 15     control means connected to said light receiving means to sense receipt of the emitted beam by said light receiving means, and to the press brake to control halting operation of the moving blade, whereby said control means causes the cessation of movement of the blade in response to a sensed interruption of receipt of an emitted beam.
- 20    2. A safety apparatus as claimed in claim 1, wherein said control means includes means for overriding the halting of the press brake by said control means after the blade descends to a predetermined position or mute point, so that said control means does not respond to subsequent interruptions of the emitted light beam.
- 25    3. A safety apparatus as claimed in claim 1 or 2, including a plurality of said corresponding light emitting means and light receiving means, the light beam of one light emitting means to be disposed to the operator side of the press brake



and the light beam of another light emitting means to be disposed to the remote side of the press brake.

4. A safety apparatus as claimed in claim 2 or claim 3 as dependent upon claim 2, wherein said control means halts the movement of the blade automatically at 5 said predetermined position or mute point above the platform, and permits the blade to move beyond this level only in response to a user of the press brake performing a manual operation associated with said control means.
5. A safety apparatus as claimed in any one of claims 2 to 4, including a further beam located directly forward of and spaced apart from the leading edge of the 10 blade, said control means being responsive to interruptions of the further beam by the item or platform to halt movement of the blade, the level above the platform at which the blade is halted being predetermined ensuring that the mute point is not too close to the item or platform.
6. A safety apparatus as claimed in any one of the preceding claims, in which 15 the beam or beams are generated by a light emitter means and received in a light receiver means each rigidly linked to the blade and moving therewith.
7. A safety apparatus as claimed in any one of claims 1 to 5, wherein the beam or beams are generated and received in a single means capable of both emitting and receiving a light beam, the single means being rigidly linked to one end of 20 the blade and a reflective or mirror means rigidly linked to the other end thereof opposing the single means.
8. A safety apparatus as claimed in any one of the preceding claims, including additional beams provided at either or both the front and/or rear of the blade thereby further limiting access thereto, the interruption of said additional beams 25 causing said control means to halt movement of the blades.



9. A safety apparatus as claimed in any one of the preceding claims, wherein said control means includes a form of Programmable Logic Controller electronically linked to the or each beam and to a motor driving movement in the beam, the Programmable Logic Controller causing the halting of movement of  
5 the blade upon interruption of the or each beam.

10. A safety apparatus substantially as hereinbefore described with reference to Figures 1 to 4.

11. A safety apparatus substantially as hereinbefore described with reference to Figures 1 and 5, 6 or 7.

10 12. An apparatus including:

a press brake having a moving blade provided with a leading edge, said blade having opposite ends and opposite sides, and a platform against which an item may be pressed; and

15 a safety apparatus connected to said press brake as claimed in any one of claims 1 to 10.

Dated this TENTH day of JANUARY 1996.

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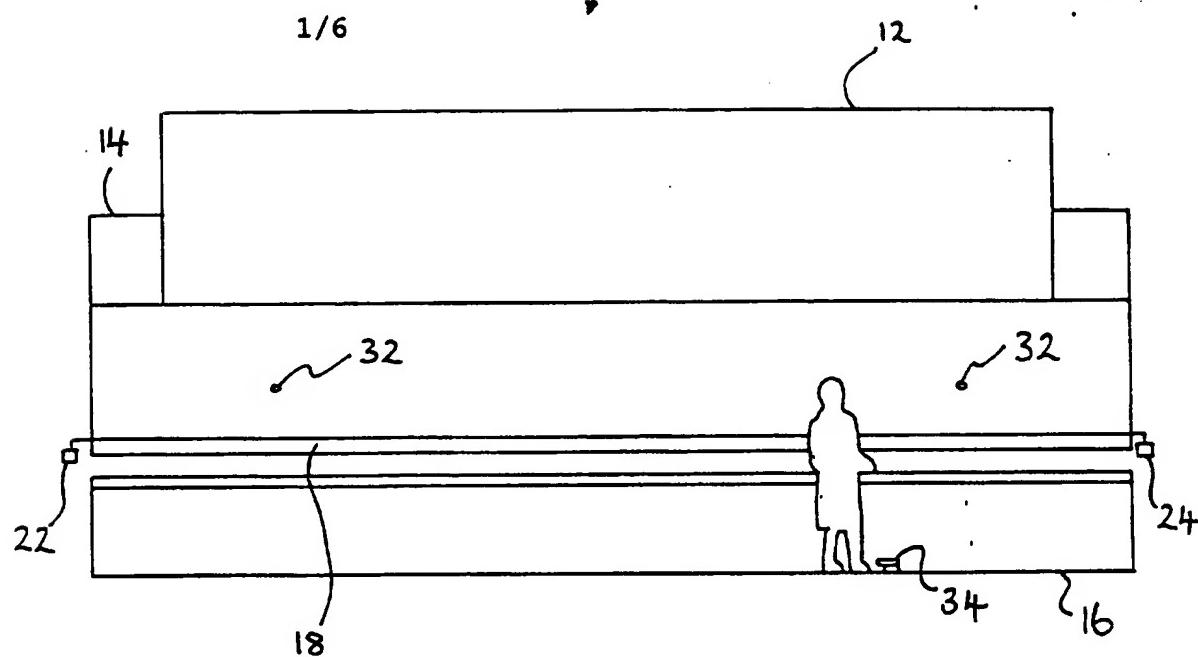


FIG. 1

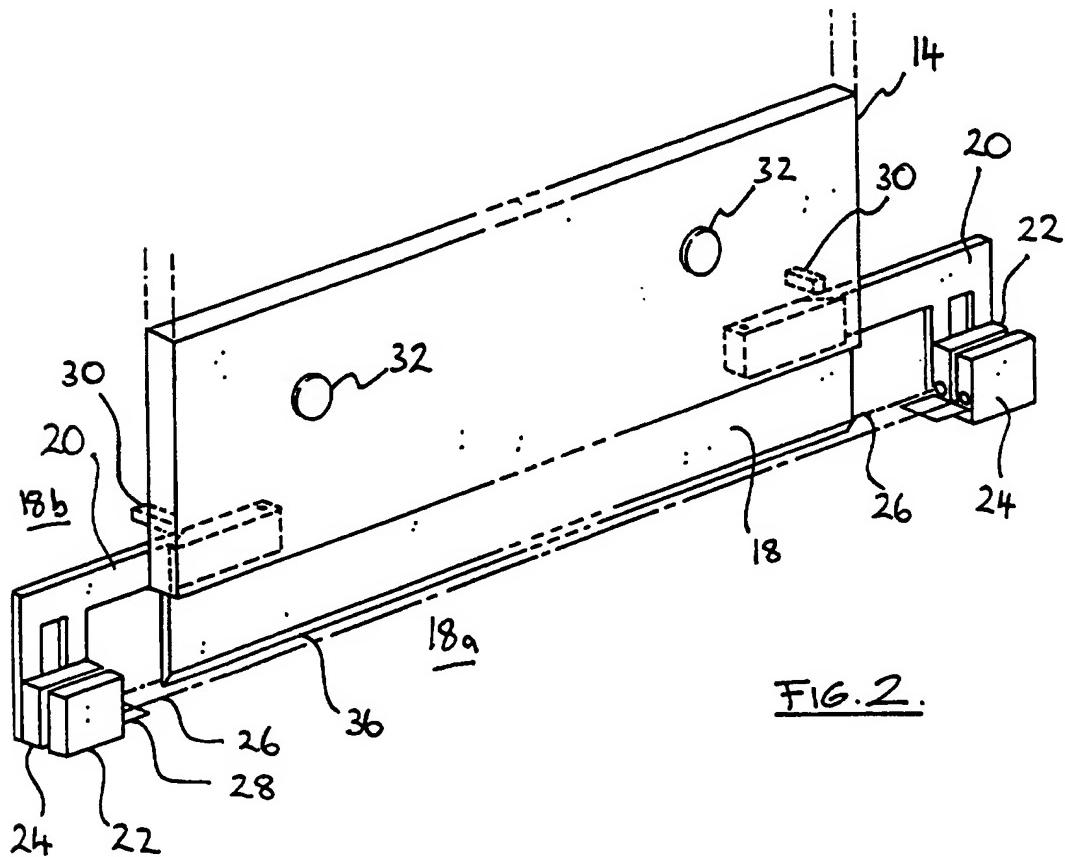
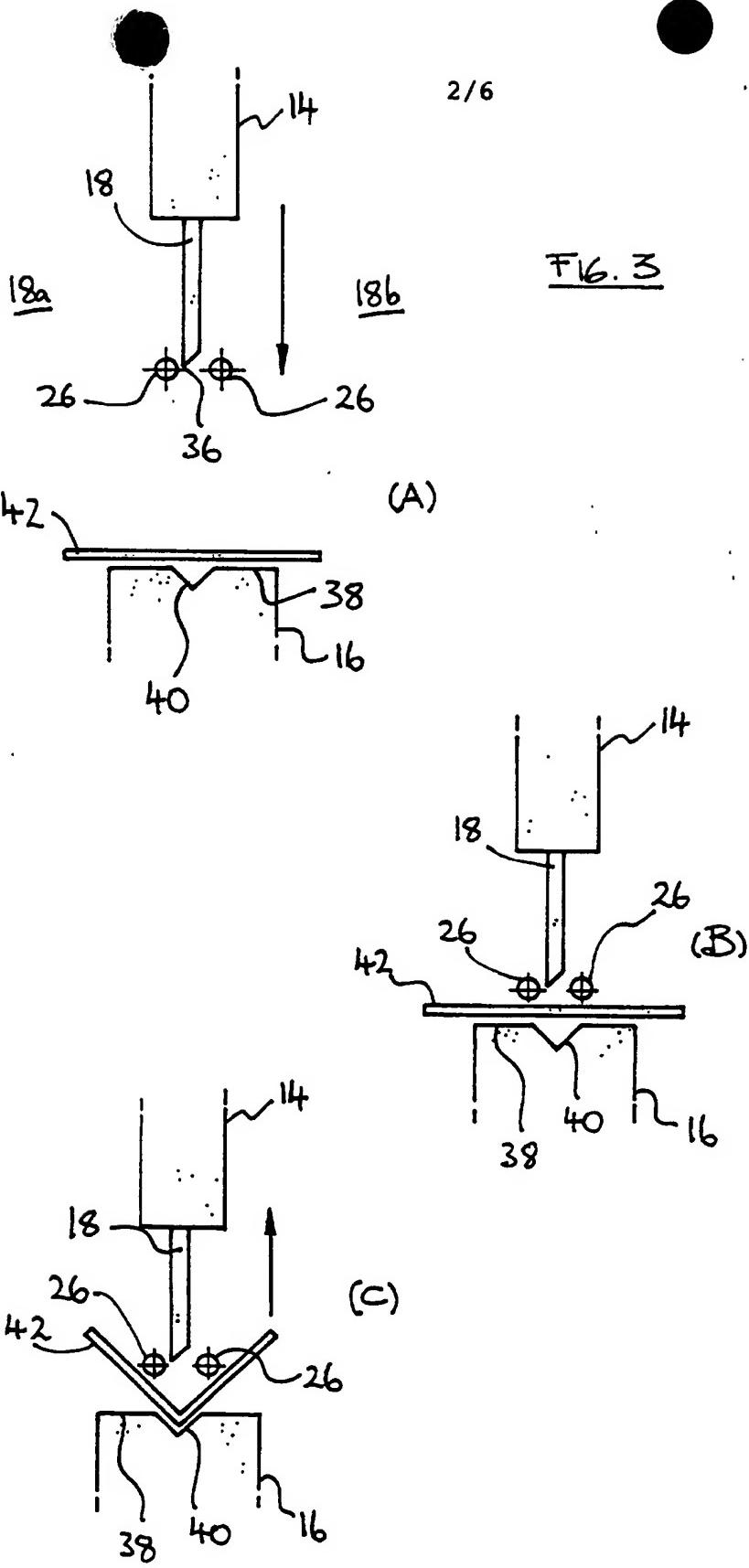
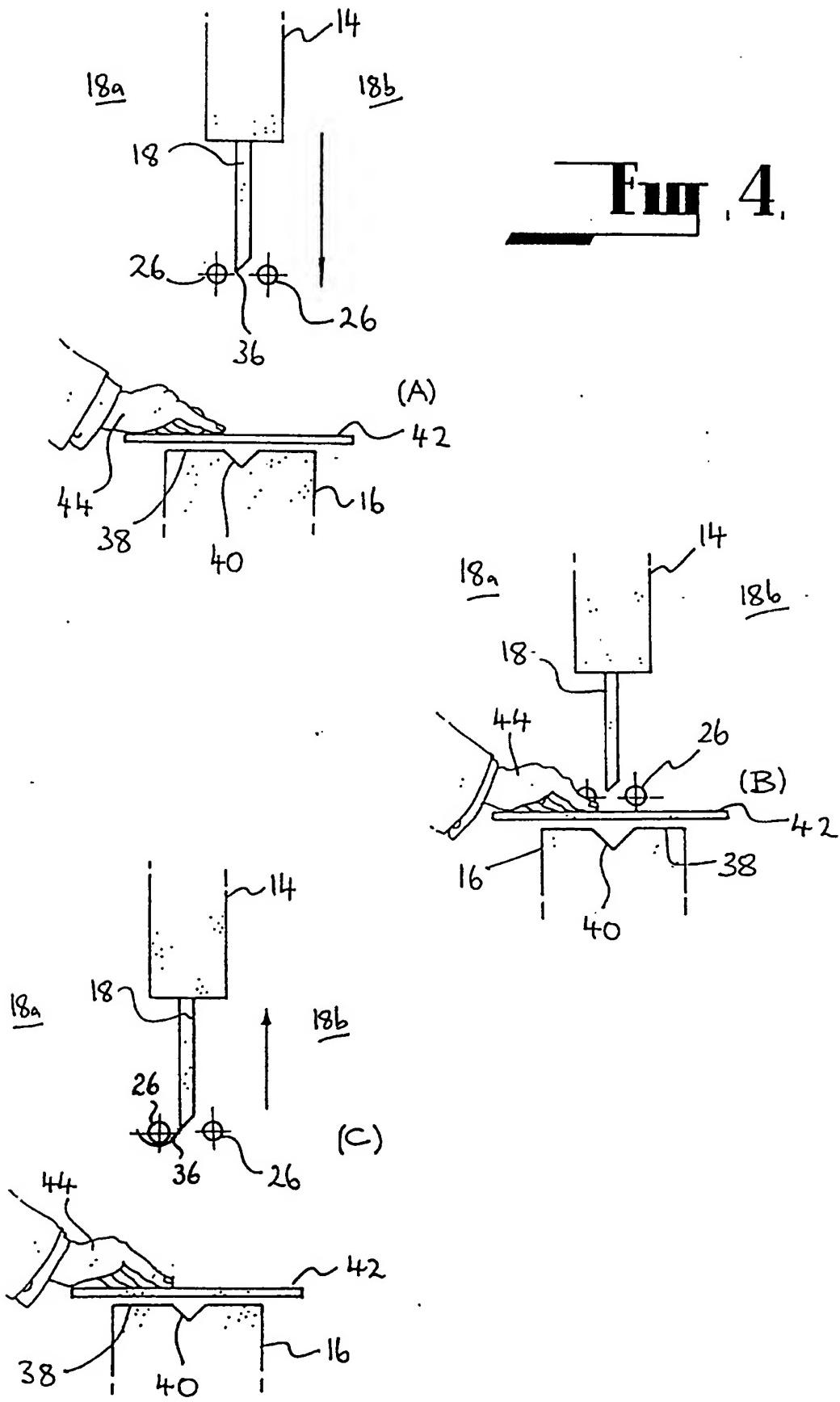


FIG. 2





4/6

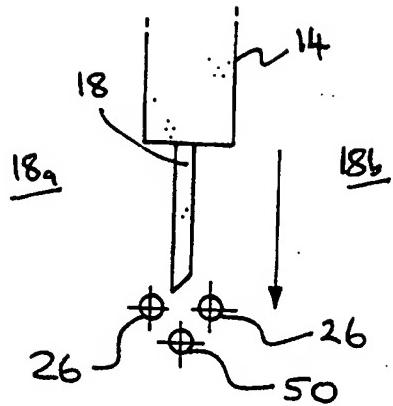


Fig 5

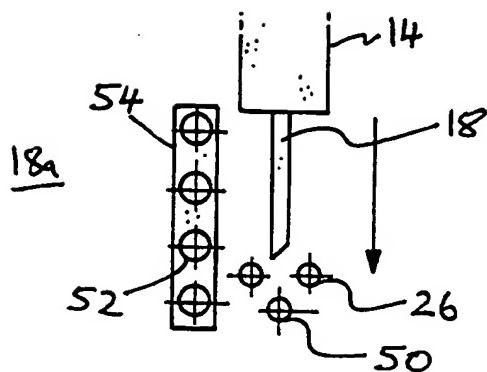
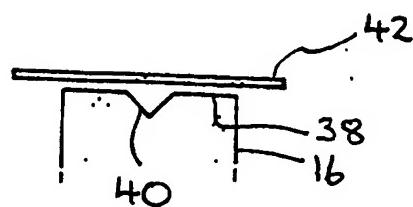
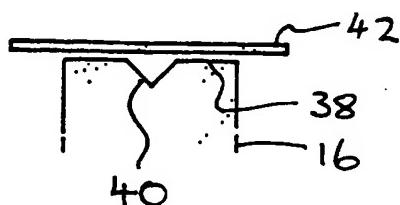


Fig 6



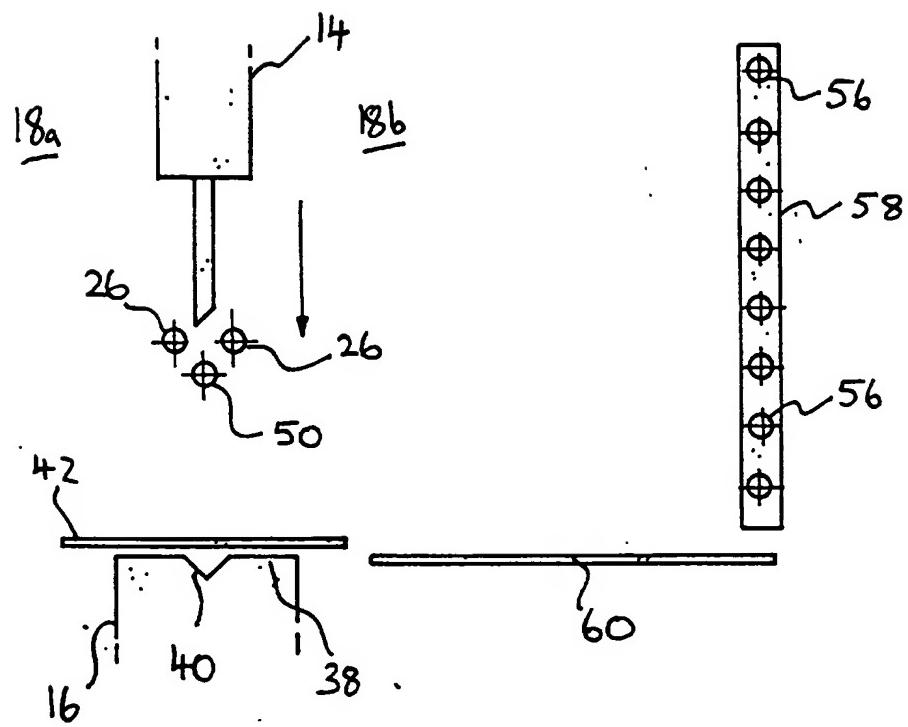


Fig 7



( PAGE - 2 )

1 R6  
25 --- / / +

X8  
28 --- / / ----- R2 [ ] ---

JOG  
R1  
29 --- / / +

X1 R4 R4  
31 --- / / ----- R3 [ ] ---

FAST  
LS  
R3  
33 --- / / +

X1 X0  
36 --- / / ----- R4 [ ] ---

FAST LS FOOT SW  
37 --- / / +

X4  
40 --- / / ----- R5 [ ] ---

EYE  
1  
X9  
41 --- / / +

EYE  
2

Fig. 8b.

Fig. 8c.

( PAGE - 4 )  
R19

X4  
60---1/1-----[ ]  
| EYE  
| 1  
|  
X9  
61---1/1+-+  
| EYE  
| 2  
|  
X7  
63---1 |-----[ ]-----Y6  
| INCR  
|  
| X2 X3  
65---1 |-----1/1-----[ ]-----R15  
|  
| LOW TOP  
| PS LS  
|  
R15  
66---1 |--+  
|  
| X1 X3  
69---1 |-----1/1-----[ ]-----R16  
|  
| FAST TOP  
| LS LS  
|  
R15 R16  
72---1 |-----1 |-----[ ]-----R17  
|  
|  
| X3 X4 X9  
75---1 |-----1/1-----1/1-----[ ]-----R18  
|  
| TOP EYE EYE  
| LS 1 2  
|  
| X2 X3  
79---1 |-----1/1-----[ ]-----R11  
|  
| LOW TOP  
| PS LS  
|

Fig. 8d.

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80 | R11 |  
 80 |---|---+  
 |  
 | X1 X3  
 83 |---|---|---|---+----- R12  
 |  
 | FAST TOP  
 | LS LS  
 |  
 | R12  
 84 |---|---+  
 |  
 |  
 | R11 R12 R18  
 87 |---|---|---|---|---+----- R13  
 |  
 |  
 | R13  
 89 |---|-----+  
 |  
 |  
 | R13  
 92 |---|---+----- Y5  
 |  
 |  
 | X3 X4 X9 R17  
 94 |---|---|---|---|---+----- R14  
 |  
 | TOP EYE EYE  
 | LS 1 2  
 |  
 | R14  
 97 |---|-----+  
 |  
 |  
 00 =====+-----!  
 00 =====END=====!  
 00 =====+-----+

## Fig. 8 e.